centuries, however, Babylon, Assyria, Mycaenae, Delos, and Asia Minor knew the lion as a wild animal, giving it a prominent place in their sculpture. One small figurine, from Aspendos in Turkey, is carved from calcilutite originally deposited in the Tethys Sea, reminding us that available indigenous raw materials have always played an important part in encouraging or limiting developments in art or technology. For instance, the famous 12th Century chessmen from the Isle of Lewis, Romanesque (and thus derivative) in design, are carved in walrus ivory and thereby identified as a product of northern Europe, since the walrus rarely straggled south of Norway (King, 1964) and its ivory was not traded as extensively as elephant ivory.

As the characteristic ornament of Corinthian capitals, the Greeks reproduced in stone the *Acanthus*, a plant native to the Mediterranean and adjacent regions ; it grows well in our New Zealand gardens but has ceased to inspire the sculptor in the Antipodes. One could continue to illustrate the part played by the local wilderness in the art forms or literature of the Old World.

Fig. 1. Lion figurine (125 mm), Aspendos, Turkey (a) ; Chessmen from the Isle of Lewis, whale ivory, c. 95 mm (British Museum) (b) ; *Acanthus* ornament on Corinthian capital (c).

Let us come nearer our own time and our own place. All immigrants to our lands brought with them the memory of a voyage and their earlier environment (Holcroft, 1943). In eastern Polynesia the breadfruit (*Artocarpus*) replaced the yam (*Dioscorea*) as the staple source of carbohydrate food. In Polynesian tradition, the migration of the Arawa Canoe to New Zealand was the result of a theft of breadfruit. Te Rangihiroa (Sir Peter Buck), bridge builder between New Zealand's two cultures, records (1974) an ancient dirge : " Sacred tree of Hawaiki, the home land, on the other side of Tahiti Nui, the *kuru* or breadfruit tree that sheltered the house of Uenuku, the high chief ". A young man named Tamatekapua and his brother stole its fruit by night and as a result his people were forced to emigrate to New Zealand where the story was handed on. But in a land where the breadfruit did not grow the elders had difficulty in explaining what the *kuru* was and substituted the *poroporo*, two species of *Solanum*, familiar blue-flowered shrubs on both sides of the Tasman with berries sometimes eaten by Maori children. *Te poroporo whakamarumaru o Uenuku*, the sheltering poroporo of Uenuku (*Solanum aviculare* or *S. laciniatum*) now contributes to contemporary culture as a source of a glycoside called solasonine, a most promising raw material for the production of steroid drugs (Lancaster and Mann, 1975) including reproductive hormones increasingly demanded by birth control programmes (Fawkner, 1974).

For new countries, colonised from afar, the relationship between culture and nature has not been easy to accept. In Australia, older and more mature as a nation than New Zealand, quite an extensive literature has appeared on cultural development, in which national and international phases seemed to alternate. Naturalists on both sides of the Tasman are likely to agree (in my opinion) with A. G. Serle (1973) that: " Culture and everything else begins from scratch in a new country, despite the inheritance of the whole of European and English culture ", and " Culture is a highly perishable growth, which, transplanted, cannot bloom as before ".

The same west European (mainly British) people brought to Australia and New Zealand memories of Yule logs and Christmas robin redbreasts as inappropriate as hot plum pudding in a southern December, yet the two environments on either side of the Tasman were sufficiently different to ensure different cultural products. To this, differences between Australia and New Zealand in physical geography, climate, and biology have all contributed. But it was not always so.

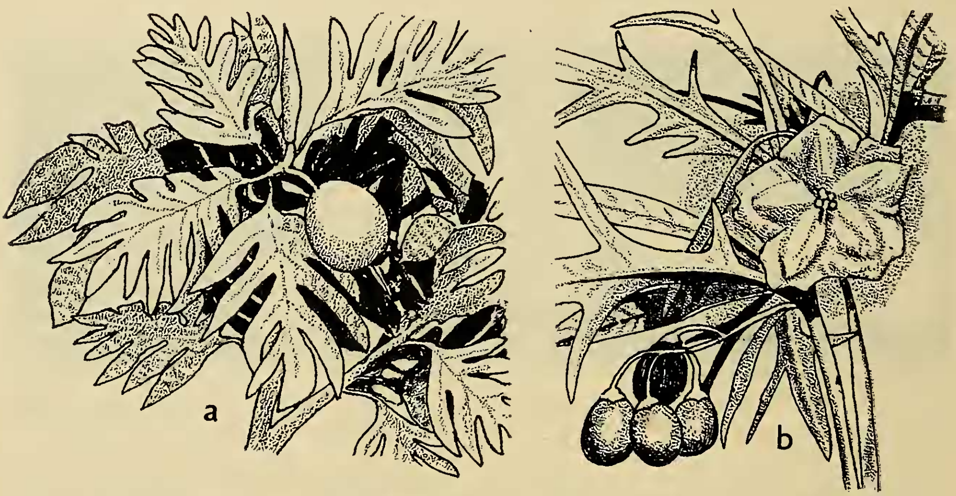

Fig. 2. Breadfruit (*Artocarpus*) (a), and Poroporo (*Solanum laciniatum*), its substitute in the Maori legend of the Arawa Canoe (b).

The concepts of a southern super-continent, Gondwanaland (Suess, 1883–1909), of continental drift (Wegener, 1924) whereby jigsaw pieces of the crust later drifted apart to become the southern lands we know today, of sea floor spreading, and of plate tectonics represent successive stages in our enlightenment, in which the conviction of geologists like S. W. Carey (1958) was confirmed, as new discoveries in sea floor structure overcame the earlier scepticism of geophysicists (see e.g. Heirtzler, 1968; Hurley, 1968; Hayes and Pitman, 1970). As P. M. S. Blackett (1965) once commented: " in complex subjects a highly simplified model which can explain a large number of facts is invaluable, especially when it suggests new observations " which generally force the researcher to make the model more complicated. Reconstructions of Gondwanaland and histories of its disruption still differ in detail but the degrees of freedom have progressively diminished as detailed analyses and interpretations bring in more and more factors to control the " fit ".

From the Permian to the Jurassic, when disruption began, Gondwanaland certainly shared a common biota. Its unity persisted as it changed during the Cretaceous while the early phases of drift took place. Permian *Glossopteris* vegetation gave way to Triassic *Dicroidium* vegetation and then in the Cretaceous to the forbears of living ferns and conifers—araucarians and podocarps—and soon afterwards to the first angiosperms, including *Nothofagus* southern beeches and an abundance of Proteaceae. The fauna included lungfishes, primitive amphicoelan frogs, the ancestors of monotremes and of ratite birds, dinosaurs and other reptiles such as rhynchocephalians. Perhaps we have exaggerated the uniformity of Gondwanaland, which certainly was at times broken up by epicontinental seas (Teichert, 1974) and was probably quite diverse in climate and vegetation so that not all parts necessarily had precisely the same biota ; but what evidence we have indicates substantial uniformity, which is why Suess invented Gondwanaland to begin with. Africa, the first continent to break away, took with it a lungfish, the two-toed ratites (which were subsequently shared with Eurasia), Proteaceae and podocarps, apparently before *Nothofagus* beeches and marsupials had evolved.

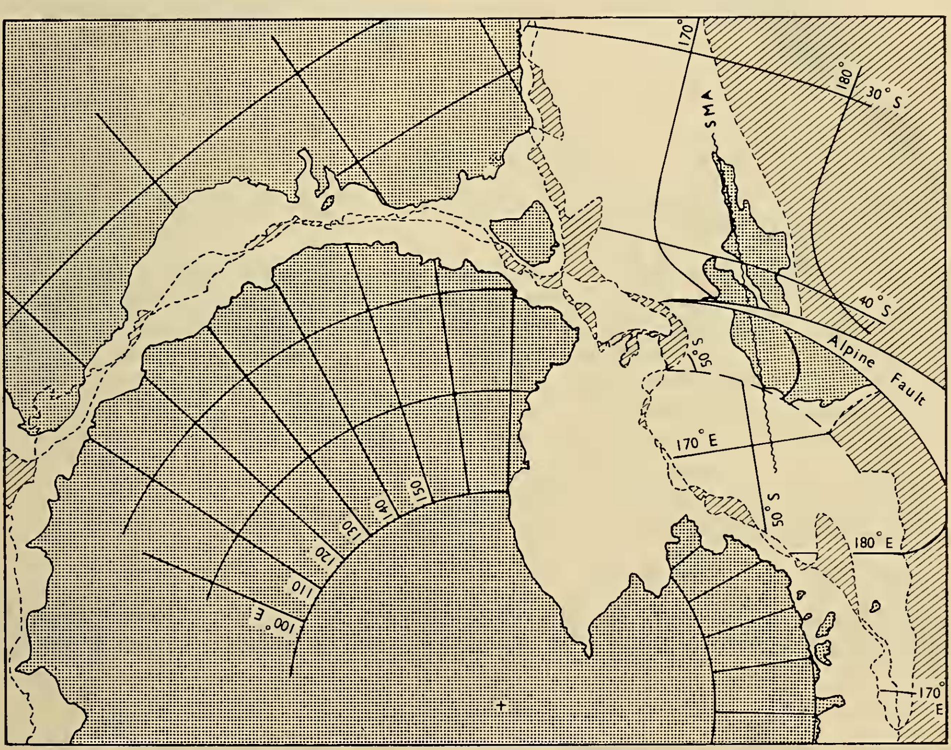

Fig. 3. The Australasian part of Gondwanaland. An assembly by R. A. Cooper (N.Z. Geological Survey) using a reconstruction of New Zealand by H. W. Wellman (1975).

Differentiation of the plants and animals in different Gondwana fragments proceeded as they separated. " Sweepstakes " colonisation across marine barriers brought different colonists to different subcontinents. There was a similar " sweepstakes extinction " that resulted from differences in survival, influenced by diverging geography and climates in the Tertiary. For much of the Tertiary Australia and New Zealand vegetation was similar, warm temperate to subtropical rain forest with dominant *Nothofagus* and podocarps and with many other common elements including araucarians and proteaceous plants and ratites.

Already, before the end of the Mesozoic, some 65 million years ago, plants and animals that contribute to our national cultures were established on either

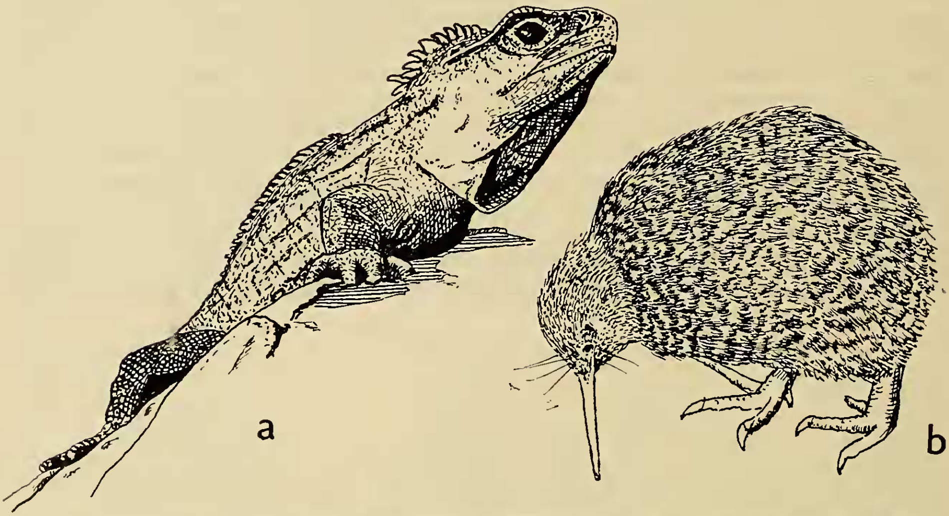

Fig. 4. *Sphenodon*, the Tuatara, last of the Rhyncocephalia (a), and the Kiwi (*Apteryx*) (b) descendants of the Gondwanaland fauna.

side of a Tasman Sea that had just begun to develop, but there were fewer contrasts in climate, vegetation and presumably fauna than there are today. Both countries share some of the Mesozoic tree ferns (mamaku and ponga in New Zealand) which characterise the rain forests on both sides of the Tasman and which inspired the New Zealand poet A. R. D. Fairburn (1966) to write " Conversation in the Bush " :

> Observe the young and tender frond
> of this punga : shaped and curved
> like the scroll of a fiddle : fit instrument
> to play archaic tunes.
> I see
> the shape of a coiled spring.

Australia must have had ancestors of such Proteaceae as *Banksia* and *Macadamia* that have undoubtedly been modified subsequently in adaptation to a drier climate.

Fig. 5. Tree-fern (*Cyathea*) with new frond " curved like the scroll of a fiddle ; fit instrument to play archaic tunes " (A. R. D. Fairburn) (a). " The Banksia men make a wicked plot " (after May Gibbs) (b).

As a child in New Zealand, fifty years ago, I was scared by May Gibbs' wicked Banksia men (Gibbs, 1946) in the absence of a local children's literature of our own. New Zealand lost most of its Proteaceae during the late Tertiary cooling, the surviving toru (*Toronia*, Johnson and Briggs, 1975) and rewarewa (*Knightia*) contributing less to our cultural life than the somewhat fuller complement of late Gondwanaland softwoods, which remained to become the " immense woods of as stout lofty timber as is to be found in any other part of the world " over which Captain Cook enthused in 1769 (Beaglehole, 1965).

Kauri (*Agathis*), totara (*Podocarpus*), and rimu (*Dacrydium*) were the raw materials for buildings, public and domestic, in the colonial period, often encouraging reproduction of stone architectural features in wood, a characteristic well illustrated by the cathedral church of St. Paul in Wellington (Alington, 1965). The development of what we may call " Podocarp Gothic " was fostered by general lack of building stones near New Zealand settlements.

Fig. 6. " Podocarp Gothic " interior of Old St. Paul's, Wellington (1866), drawn by W. H. Alington (a). Pioneer farm house, " Kauri Classical " urban façade, and Selwyn Church (after Juliet Peters) (b).

The history of much of New Zealand landscape also applies to many parts of Australia—the felling and occasional milling of the forest prior to burning, the pioneer house set among gaunt blackened trunks, the wide spectrum of architectural styles, with the Indian verandah imported in response to abundant sunshine. Podocarp Georgian and Kauri Classical façades fronted urban buildings walled in corrugated iron at the back (out of sight) and in New Zealand Bishop Selwyn designed a standard colonial church for country villages. It is all part of a new land's history but how much of this is really national when the forest has gone ?

The rich timber resources were squandered as the land was cleared wastefully and often unwisely for pasture, locally on slopes of highly erodable sedimentary rocks, leading to serious sheet and gully erosion (Cumberland, 1947). In both our countries, the " western " idea of a struggle against nature too long prevailed over the still older cult of forests that led to reservation of hunting preserves, the sacred copses of Diana (Frazer, 1922), avenues of Japanese *Cryptomeria*, the temple ginkgos of China, and the tapu groves around Pacific maraes (Fosberg, 1975). In both our countries, ignorant or overkeen land use led to land abuse. Destruction of native forests continues today for chipboard and pulp industries. " Are we to assume ", asks the New Zealand writer M. H. Holcroft, " that a people which possessed the land in this manner—raping it in the name of progress—can remain untroubled and secure in occupation ? ". Conservation is more than practical remedies to soil erosion (Allsop, 1973)—it is the symptom of uneasiness, of a growing realisation that a new land cannot be exploited with impunity (Holcroft, 1948).

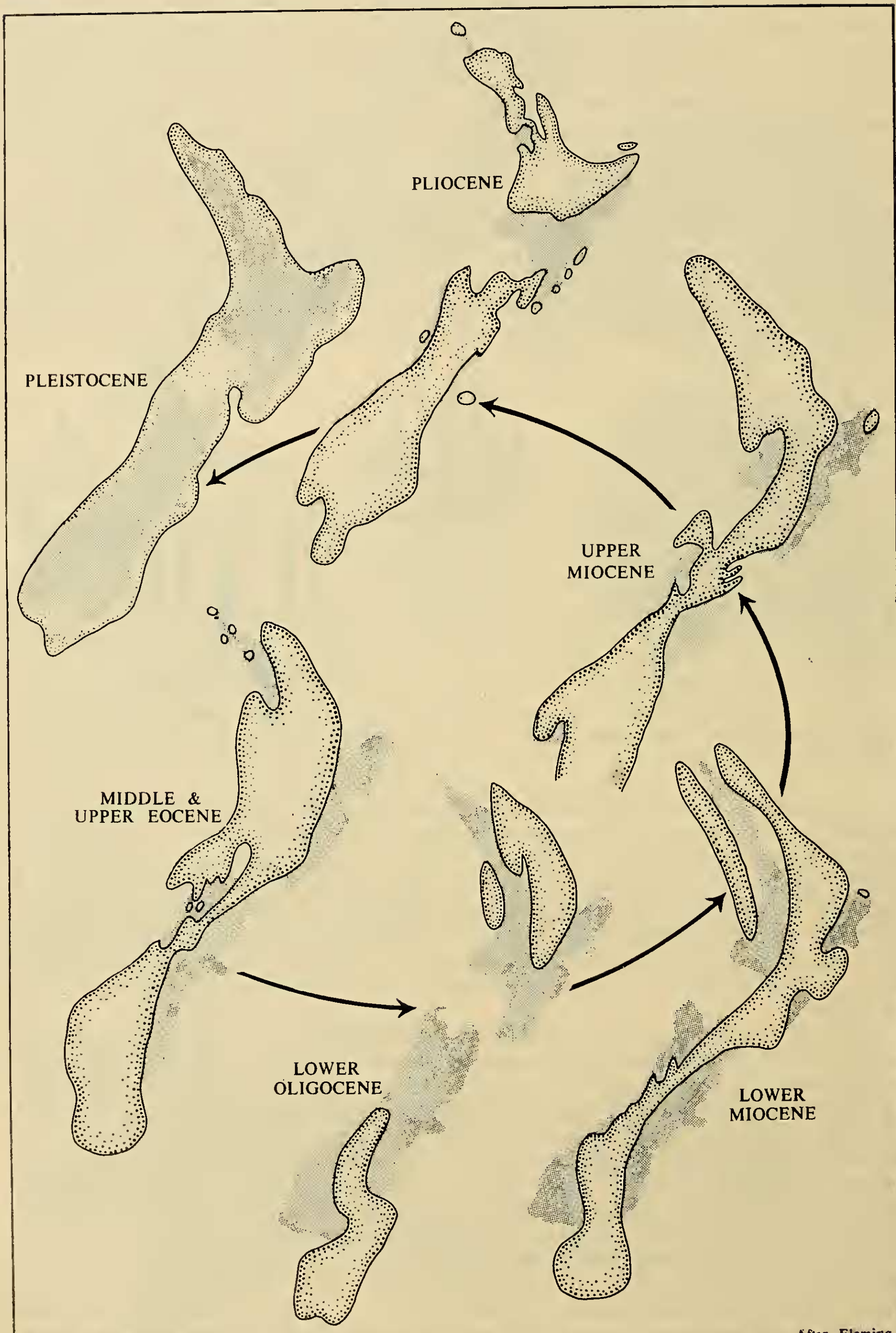

Fig. 7. The changing archipelago of New Zealand during the Cenozoic.

It would accord well with the biogeographic evidence if the Gondwana fragments (apart from Africa) remained linked via a temperate Antarctica, long enough to permit the well documented dispersal of southern beeches of three *Nothofagus* species-groups in the Upper Cretaceous (Couper, 1960) and presumably also of the ratites, but not long enough for New Zealand to receive the doubtful blessing of marsupials and snakes (which have an inadequate fossil record to date their arrival precisely). On the other hand no such juggling with the time-scale can account for the absence from New Zealand of monotremes, which G. G. Simpson (1961) believes reached Australia in late Triassic or Jurassic times.

In the Oligocene New Zealand was reduced to a number of rather small islands (Fleming, 1975). Monotremes (or any other organisms) might then have been eliminated in the almost random extinctions postulated by the theoretical discussion of island populations we owe to McArthur and Wilson (1967), recently confirmed by J. M. Diamond from direct observations (1972, 1973).

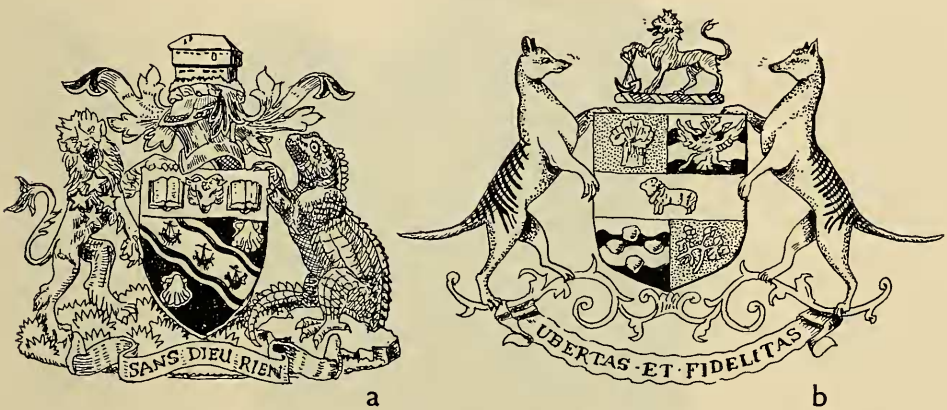

Fig. 8. Heraldic lion, Tuatara (*Sphenodon*), and Thylacines in the coats of arms of the Town of Wanganui (a) and the State of Tasmania (b).

Some such random extinction and survival—or at least it often seems random but is probably deterministic—left New Zealand with primitive frogs and *Sphenodon* (the tuatara) but no lungfish or monotremes. Evolutionary divergence and adaptation to contrasting environments resulted in many other differences—for instance among the ratites, the emus, casuaries and extinct dromornithids of Australia and the extinct moas and nocturnal forest-dwelling kiwis of New Zealand (Fleming, 1974).

The zoological interest of the legacies from Gondwanaland is not always matched by their cultural significance, but heraldry delights in rare or imaginary animals. The tuatara is a supporter in the arms of the New Zealand city of Wanganui, sharing the honour with the heraldic lion of mediaeval Europe. Wellington uses the extinct moa, probably imitating the emu as supporter in the Australian arms. Tasmania has a pair of thylacines. I want to make the point that the only nationally distinctive elements in these national, state and civic emblems are the indigenous organisms ; the rest are trite relics of mediaeval heraldry. Heraldry itself is trite, if not extinct, succeeded in the modern world by advertising, in which our biological symbols, Australian kangaroo and New Zealand kiwi, still find a role on such diverse products as adhesive labels, boot polish and breakfast cereals.

As our two countries drifted towards their present relationship with each other and the rest of the world, their biotic contrasts increased. Marine transgression in subsiding basins before Australia reached the horse latitudes merely delayed the onset of savanna and desert climates (Rich, 1975). In New Zealand, however, a rapidly changing archipelago never produced rain-shadow deserts so that closed-canopy forests persisted, their dominant trees varying from podocarps to *Nothofagus* of the *fusca* or of the *brassi* groups, the latter now restricted to Papua New Guinea and New Caledonia. While Australian marsupials, birds and reptiles radiated adaptively to fill diverse ecological niches, in New Zealand ratites (especially moas) and other birds did the same, although few of the products of such radiation have survived until today.

In the absence of mammals, some of the niches normally occupied by mice and voles were filled by the giant wingless Orthoptera (related to those known in Australia as king crickets) which we call wetas. These " invertebrate mice ", as H. N. Southern once called them, are nocturnal browsers on foliage which

Fig. 9. Tree Weta (*Hemideina megacephala*) on *Macropiper* leaf. Woodcut by the late E. Mervyn Taylor (copyright).

have adaptively radiated to occupy diverse habitats in coastal scrub, lowland forest, subalpine meadow and alpine fellfield, retreating to holes in trees, burrows and rock crevices by day, and producing droppings hard to distinguish from those of rodents. The largest have the biomass of a small rat, and I can assure you that they are twice as frightening to a child on actual encounter as May Gibbs' Banksia men.

When Australia began to butt against the arc of Indonesia it gained a more ready access to the biological treasures of the Orient than New Zealand has ever attained. With a very complete fossil record of marine organisms and terrestrial plants (mainly through their pollen), we have built up a register of new appearances, thus presumptive colonisations of New Zealand, through Tertiary time. No one has yet performed the same exercise for Australia. When newcomers are classified according to their probable source area, we find a

Malayo-Pacific tropical element reaching its maximum in the Miocene, together with circumpolar old and young Austral elements. In addition there was always a substantial and sustained influx of Australian colonists. Among birds, which have no fossil record to speak of, the Australian element is represented, for instance, by three endemic genera of honey-eaters, one of which, the New Zealand bellbird, is sufficiently like an Australian *Meliphaga* in behaviour as well as appearance to authenticate its origin.

Bellbird enjoyed the party with other New Zealand forest birds, invited by an English sparrow, who had been exploring New Zealand bush in Mollie Atkinson's classic " Richard Bird in the Bush " ([1944]), " written for Richard, age four, who came from England ". This children's book is full of rhyming more memorable than many of last century's sentimental adult verses on the New Zealand bellbird, which were far outdistanced by Kendall's poem on Australian bellbirds.

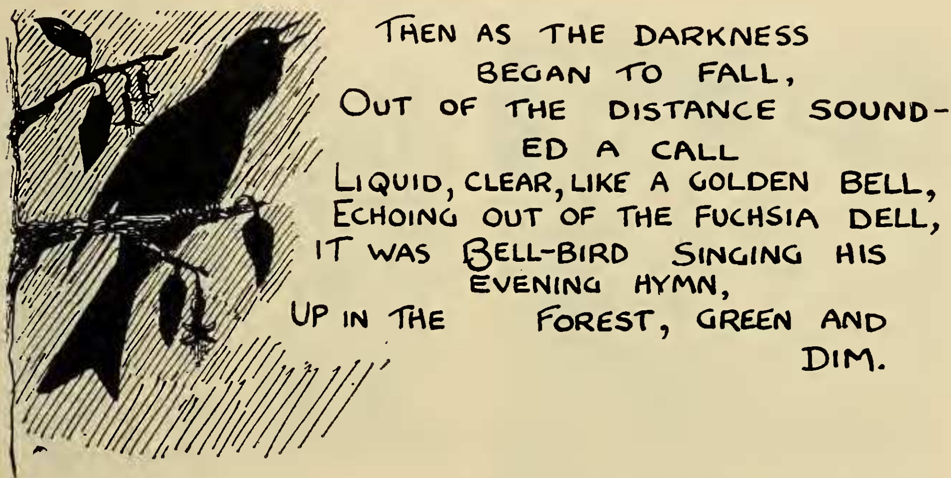

Fig. 10. New Zealand Bellbird (*Anthornis melanura*), a representative of Australian Honey-eaters (from Atkinson, 1944).

I suspect the history of Australian life, when the fossil data from Tertiary deposits in Victoria and South Australia are analysed, will be essentially similar to New Zealand's, but since New Zealand projects further south, in the long run it received more Austral circumpolar elements than Australia. Southern Ocean seals, albatrosses and penguins (for instance) may have always meant a little more to New Zealanders, I think, than to most Australians, except in the early days when Sydney was the main port for vessels sealing to the south of New Zealand (and perhaps later when a magazine called *Angry Penguins* was published in Adelaide). Similarly New Zealanders are seldom long out of sight of the sea so perhaps more conscious of it, looking outwards from the sea-shore whereas the Australian looks inwards to the interior. Here is perhaps a reason why the New Zealand Oceanographic Institute published the best compilation I have seen of the bathymetry off the Sydney coast (van der Linden and Herzer, 1975).

On the withdrawal of Tertiary seas from interior basins, Australia's climate eventually became fully continental. Rain forests gave way to savanna and desert as rainfall was reduced. The first recorded fossil *Eucalyptus* seems to be Oligocene (Gill, 1975) and its subsequent adaptive radiation to fill all niches has not yet ended. No other country, let alone continent, has so many of its plant communities dominated by a genus that is so peculiarly its own. Hans Heysen is said to have made the gum tree the symbol of Australian art, after a period when colonial artists failed to capture its spirit, making the Australian bush (and the New Zealand bush for that matter) look like the Bois de Boulogne, but its cultural influence began with Joseph Banks right in the beginning, and has continued unbroken,

While from a gully down the glen,
The foliage of the dull-leaved trees
Rises to view, and the calm air,
From stillness for a moment waked
By parakeets' harsh chattering,
is hushed again.

That was Alexander Bathgate, a New Zealand poet cited in Australian anthologies (e.g. Sladen, 1888), perhaps thanks to the Bank of New South Wales which employed him. A. D. Hope, more recently (1939), wrote of

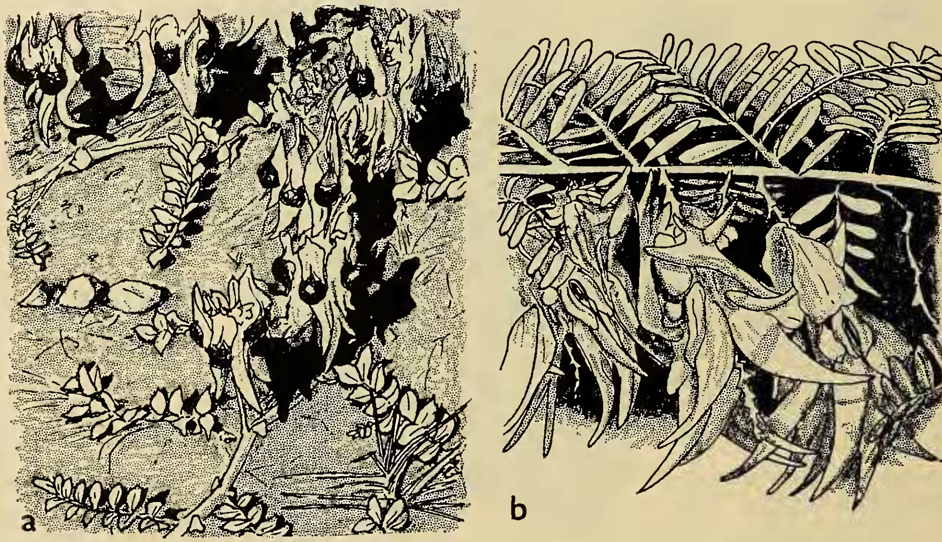

Fig. 11. Adaptation to contrasting environments. Sturt's Desert Pea (*Clianthus formosus*, Australia) (a) and Red Parrot's Beak (*Clianthus puniceus*, New Zealand) (b).

A Nation of trees, drab green and desolate grey
In the field uniform of modern wars.

Eucalyptus could not cross the Tasman, but New Zealand had earlier received several other myrtaceous plants including *Metrosideros*, a rain forest genus of trees and vines as spectacular in its season as the Western Australian flowering gums. The rata and the coastal pohutukawa inspired both Maori and Pakeha. A. R. D. Fairburn (1966) remembered from afar the " summer when the

coasts bear crimson bloom, sprinkled like blood
on the lintel of the land "

The tiny seeds of *Metrosideros* have reached far flung Pacific volcanic islands, including the subantarctic Auckland Islands in post-glacial time and several tropical islands. Its absence from east Australian forests may perhaps be due to its high palatability. The introduced Brushtailed Possum (*Trichosurus*) is blamed for the defoliation and death of trees in several parts of New Zealand

(Holloway, 1959 ; Pracey, 1969 ; Meads, 1976) and is ranked as a noxious animal, whereas it is protected (and rightly so) as a native species in most states of Australia.

By the end of the Tertiary period, Australian and New Zealand landscape, vegetation and animals showed vivid contrasts due to dissimilar topography and climate and the differing, if overlapping, source areas of biological colonisations. The differences were accentuated in the Pleistocene.

Tectonic movements of the Kaikoura Orogeny produced a " land uplifted high ", as Abel Tasman described it, transverse to the wet winds from the west ; " the uplifted structure, Peak and pillar of cloud.—O splendour of desolation ! " of Allan Curnow (1942). Young soils, ranging in fertility from the skeletal soils of the mountains to the alluvium of flood plains, cloak a landscape of young surfaces (Gage and Soons, 1974) in contrast to the ancient laterite and silcrete soils of Australia. Such contrasts in soils are reflected directly in land use and indirectly in the biotas they support.

Australia is the flattest continent and the driest, but with greater climatic diversity than New Zealand. In response to these differences the same organic stocks sometime diverged—Sturt's desert pea, reminding us of heroic explorations in the desert, contrasts with the Kowhai ngutukaka or parrot's beak of New Zealand's humid north, a species of the same genus *Clianthus*. Similarly the apostle bird of Australian savannas contrasts with the Kokako, which may be its distant cousin in the New Zealand rain forests (Alexander, 1926).

The onset of glacial climates, alternating with periods of interglacial warmth, affected all temperate lands during the past two million years. Having no escape north of 34°S in New Zealand, many less tolerant organisms (e.g. *Casuarina*) retreated, " walked the plank " and were lost for ever, while in Australia they survived and thrived. Alternating high and low sea levels bridged and then flooded the straits, separating the islands of New Zealand and Bass Strait (Keast, 1961) thus increasing the biotic diversity near the barriers by speciation of separated populations. At roughly the same Pleistocene date " the repeated waxing and waning of the dry centre, due to alternation of dry and pluvial periods " (Serventy and Whittell, 1948 ; Serventy, 1972) led to further diversification.

Division of New Zealand into two or more islands, at a time when glacial conditions first set in, led to ecological differentiation of isolated populations to produce alpine derivatives of forest organisms, plant and animal, such as the alpine Kea Parrot derived from the Kaka of the forests (Fleming, 1974, 1975). This alpine parrot impresses its personality on a mountain-loving nation, especially (in the words of James K. Baxter, 1960) on

. . . those who sleep in close bags fitfully
Besieged by wind in a snowline bivouac :
The carrion parrot with red underwing
Clangs on the roof by night . . .

Mostly the Ice Age events accentuated the differences, but not always. Australian colonisations of New Zealand continued, the colonists transported by the relentless westerlies, replacing some of the autochthones exterminated during the equally relentless glacial ages. More bird species have colonised New Zealand since the Neogene than survived from all earlier colonisations (Fleming, 1962), a statistic emphasising the rapid turnover rate of island biotas. And among plants at least, there was some return traffic, to judge by the occurrence of odd species of dominantly New Zealand genera like *Hebe* (Fleming, 1976) and the alpine *Celmisia* in eastern Australia, posing questions of paleoclimatology to provide satisfactory dispersal mechanisms westwards.

The distinctive pollen grains of *Acacia* have recently been discovered in New Zealand in the Pliocene and early Quaternary (Mildenhall, 1972), at a time when more savanna-like vegetation seems to have replaced the closed-canopy forests, at least locally, perhaps in a cool period, but it did not survive. At least one overseas botanist refused to believe this because it upset his theories, but the evidence includes groups or polyads of characteristic cognate pollen grains still cohering and thus too heavy for aerial transport across the Tasman. Moreover, our palynologists can now predict where they will find *Acacia* pollen in the rocks. The poet James McAuley (1946), in the poem " Terra Australis ", has provided an apt if unconscious comment when he wrote " the wattle scatters its pollen on the doubting heart . . .".

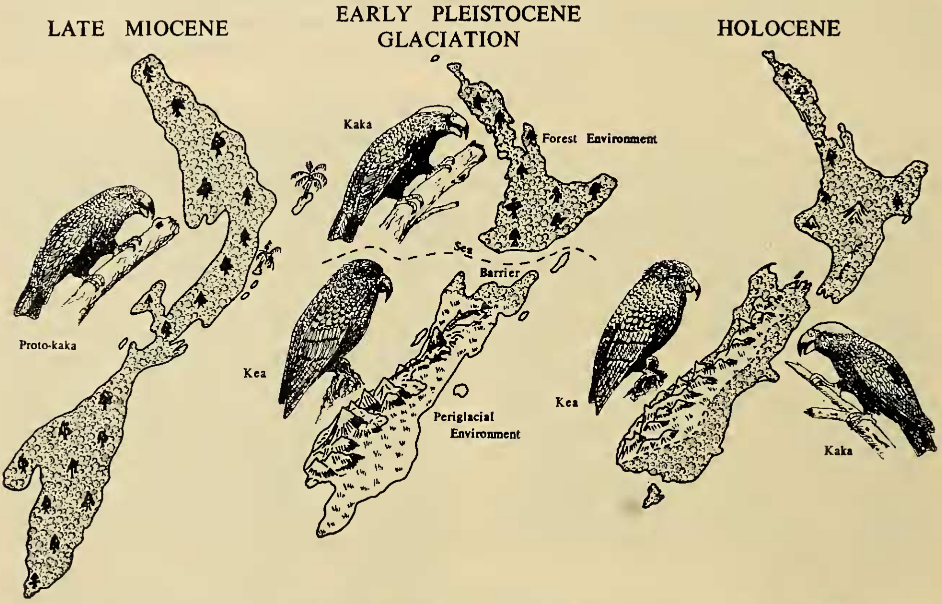

Fig. 12. Speciation in *Nestor* parrots to produce an alpine species, the Kea, living sympatrically with its congener, the Kaka, of lower altitude forests.

In most continents, Pleistocene animals contended not only with ice age climatic fluctuations but with the gradual evolution of one of their members, man, to become an unrivalled competitor and predator. Those animals that survived were invincible. In Australia man came suddenly on the scene across the Timor Strait during the last Ice Age some 30,000 years ago and his traumatic effects on an isolated biota are still not fully appreciated. The ecological changes he initiated with the help of fire almost certainly reduced the area of what would otherwise have become (or remained) continuous woody vegetation to open-canopy savanna, scrub, or grassland in the post-glacial period. He exterminated (although not necessarily by direct action) the Dromornithidae, the flamingo, and many marsupials including *Diprotodon* and *Thylacoleo*, and restricted the distribution of other animals (*Thylacinus*, *Sarcophilus*, *Zaglossus* ; see Gill, 1975). As he became adapted to an Australian environment that probably became harsher in post-glacial time, the Aboriginal Australian, with the dingo, unintentionally exterminated fragile evolutionary products of a secluded continent (Blainey, 1975) more easily than modern man with all his science and technology is finding the task of controlling (let alone exterminating) such virile Palaearctic species as the rabbit, rats and red deer which evolved with him.

In New Zealand the fauna was even more unbalanced and fragile, with few predators and no mammals other than bats and seals, when Polynesian man arrived from the Pacific only one thousand years ago with his attendant dogs and rats and his use of fire and a developed hunting technology (Cowan, 1976). The vegetation had barely recovered from the Last Glaciation before it felt man's impact. Dated charcoal in soils shows that large areas of lowland forest were burned and replaced by bracken, scrub and tussock grassland (Molloy, 1969). The faunal losses included an endemic suborder of ratites, the moas (with two families or subfamilies), and sixteen endemic genera. The casualties included some fourteen species of moa, a pelican, a flightless goose, four ducks, two harriers, two eagles, four flightless rail genera, an owlet-nightjar, a crow and a swan that was probably black.

Black swan leaving
    Your reedy nest
To sail on the waters
    With quiet breast,
While you are far
    The grey rat has come
Destroying, despoiling
    Turn again home.

—James McAuley (1956).

Polynesian rats are capable of killing albatrosses in their nests, but the Australian swans were apparently less vulnerable than New Zealand ones. Many other animals, vertebrate and invertebrate, while not exterminated, were restricted to a portion of their former ranges.

Our first human colonists, like many of the Tertiary immigrants, were Malayo-Pacific or Indo-Pacific elements if we class them in biogeographic categories. They laid the foundations of human culture in these lands. The Europeans who followed them were Palaearctic and soon brought Palaearctic rats, cats, pigs, and foxes or mustellids to press on with the biotic modifications and sound the death knell of an ecology of isolation. Not only predators were imported, of course. In New Zealand we have a varied mosaic of the world's plants and animals : Scotch, Grecian and Maltese thistles, Austrian chamois, Russian knapweed, Manchurian wild rice, Himalayan thar and honeysuckle, Indian myna and turtle dove, Japanese sika deer and wineberry, Cape tulip and Sodom apple from North Africa, Canadian geese and salmon, Californian quail and cypress, Tasmanian ladybirds, Mexican prickly pear, South American *Nasella* tussock, as well as plants, frogs, marsupials and birds from Australia. Many are dominant organisms in our modified landscapes, which indeed would be drab (or drabber) without them (Fleming, 1973), but they are an *international* contribution to our culture, not a *national* one.

J. M. Bechervaise (1967) has listed the carolling of magpies as one of the irreplaceable values that an Australian misses most and speaks about when questioned overseas about his homeland. Yet this quintessence of the Australian outdoors is now diluted by being shared with New Zealanders, one of whom, Denis Glover (1960), has even written a poem called " The Magpies ".

When Tom and Elizabeth took the farm
    The bracken made their bed,
And *Quardle oodle ardle wardle doodle*
    The magpies said . . .
Elizabeth is dead now (it's years ago)
    Old Tom went light in the head :
And *Quardle oodle ardle wardle doodle*
    The magpies said.

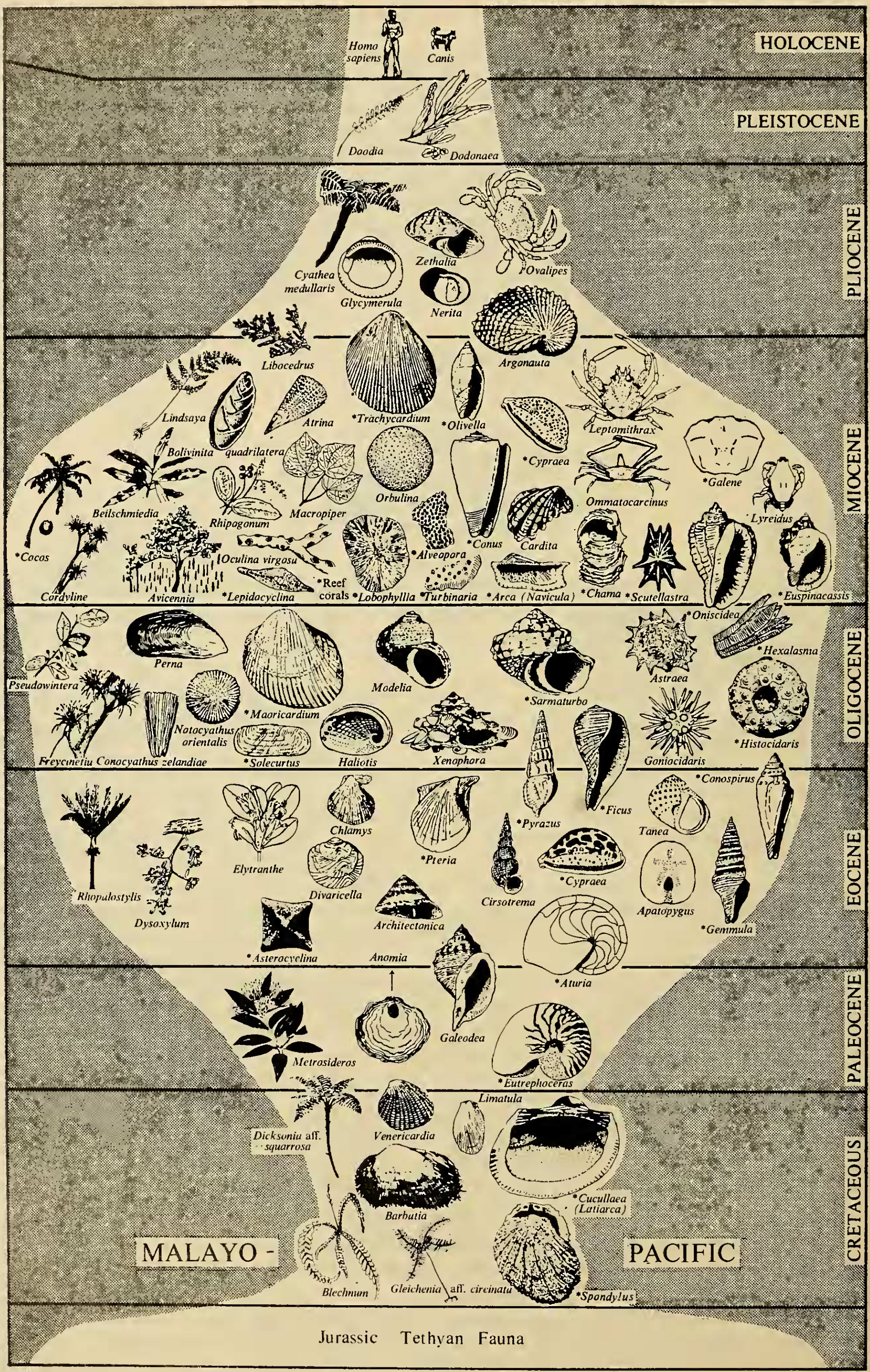

Fig. 13. Diagram illustrating Mid-Tertiary climax of the Malayo-Pacific element among colonists reaching New Zealand, with Polynesian man and his dog shown as late arrivals in the Holocene (from Fleming, 1975).

Sounds of bird or cicada are evocative of memories and emotions but there seems little future (in my opinion) in a music that tries to be national by using the distinctive calls of bush birds, as advocated by Henry Tate (Serle, 1973). Beethoven got away with quails and cuckoo but orchestrated kookaburras and tuis are no substitute for the real thing. Local musicians, however, who " grate on their scrannel pipes of wretched straw " depend on the wilderness to provide this raw material. The Maori uses raupo (bulrush) to make his own rhythmic percussion instruments, the *poi*, the " tiny ball on end of string " that an Australian composer, Alfred Hill, celebrated in his *waiata poi*, a song made popular by Peter Dawson. We owe a lot to Australians, from the times of George French Angas (1847), who illustrated the New Zealanders and their clothing in a generation of transition. Bulrush is cosmopolitan, but the main raw material for the textiles worn by Angas's Maori subjects was the endemic New Zealand flax, *Phormium*, basis of the first manufacturing industry, which persisted until quite recent years, providing fibres for wool packs, twine and floor coverings.

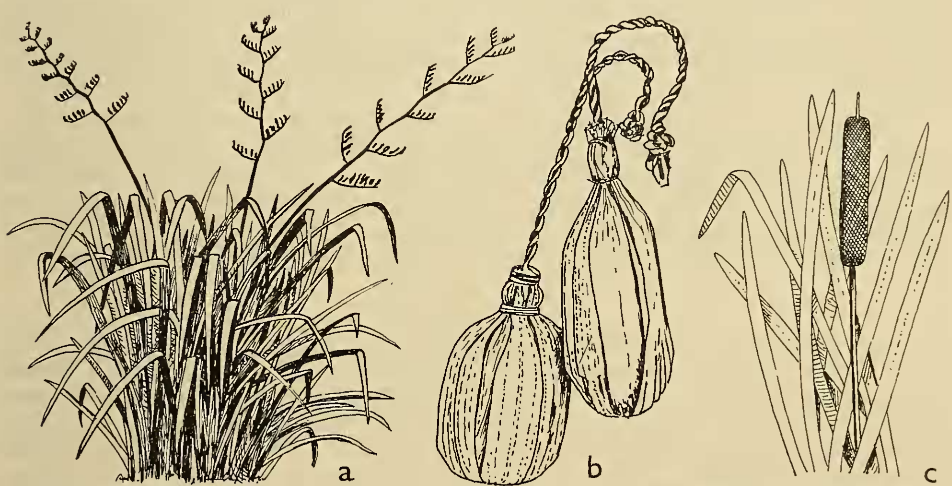

Fig. 14. New Zealand Flax (*Phormium*), endemic raw material for Maori textiles and European woolpacks (a), the " poi " used as percussion instruments in Maori dancing (b), and the cosmopolitan bulrush (*Typha*), from which they were generally manufactured (c).

Our New Zealand biota has taken such a battering that we are glad to restore its diversity with magpie, swan and kookaburra, even katydid and mantis, to say nothing of ornamental wattles, bottlebrush and waratahs in our gardens. Horticulturally, if not culturally, New Zealand makes a modest return, with any of a dozen cultivars of the prolific genus *Hebe*, the hedge plant known as taupata or mirror leaf (a species of *Coprosma*), and other garden plants, and maybe we still have unexploited resources like the Poor Knights lily, *Xeronema*. These are as important cultural exchanges as a loan collection of paintings but only in the donor country are they part of the national culture.

Not all culture is based on the wilderness but cultural phenomena not so based seldom begin or persist as national traits. Even physical geography is seldom unique to a nation. The bold coasts of Fiordland, without their New Zealand vegetation, could be mistaken for Norway. My thesis does not deny the beneficial function of international culture in promoting understanding and peace. To quote P. R. Stephensen (1936), " there is a universal concept of humanity and world culture but it does not destroy individuality . . . Cultures remain local in creation and universal in appreciation ". If we were textbook scientists, thoroughly logical, we would accept all the changes brought about by man—extinctions, modifications, introductions—as an interesting continuation of our biogeographic history. We have no option in many cases. But for the first time in the history of life, some changes can now be made subject to human management based on value judgements.

In this lecture, I have implied that indigenous plants and animals are more important as cultural influences than introduced ones and that endemic organisms can be the most important of all if they affect our thoughts and feelings, notwithstanding the links with our own ancestral western traditions and history provided by introduced organisms, many of which are also profitable. Britain and Japan, largely repopulated by plants and animals in the last 10,000 years since the Ice Age wiped the slate clean, have nothing to equal the interest and uniqueness of the venerable (but vulnerable) survivors of Gondwanaland and the earlier years of continental drift. Such organisms have been Australians or New Zealanders for 50 to 100 million years. The distinctive cultural contribution from endemics is a logical basis for decisions on environmental conservation and land use. It also justifies educational policies that give as much (or more) attention to the special and individual geological histories of national territories and biotas as to the universal laws and principles of biology such as mitosis and the genetic code. These things I believe with a quite unscientific fervour.

Not only " from the deserts " do " the prophets come " (A. D. Hope, 1939) ; on the far side of the Tasman they come from the encircling seas, the waiting hills and primaeval forests (Holcroft, 1948, 1950). But always they come from the wilderness, to which we return, as peoples or as individuals, to charge our batteries when standards begin to disintegrate, when foundations of culture begin to weaken, when we need renewed confidence in a national future.

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THE FOOD PLANTS OR HOSTS OF SOME FIJIAN INSECTS. V.

William Greenwood*

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Credit for the various records is given by initials as follows :

W. Greenwood (W.G.), R. Lever (R.L.), R. Paine (R.P.), G. Robinson (G.R.), R. Veitch (R.V.).

Lepidoptera

Except where otherwise stated, the records for Lepidoptera refer to the feeding habits of the larva.

TORTRICIDAE (TORTRICINAE) : *Adoxophyes fasciculana* (Walker) feeds on leaves of *Camellia sinensis* (L.) Kuntze (Theaceae) (R.L.), *Jasminum sessile* A. C. Smith (Oleaceae) (W.G.) and *Jasminum simplicifolium* Forst. f. (Oleaceae) (W.G.)

TORTRICIDAE (OLETHREUTINAE) : *Cryptophlebia vitiensis* Bradley feeds on seeds of *Albizia procera* (Roxb.) Benth. (Mimosaceae) (W.G.) and *Pithecellobium dulce* (Roxb.) Benth. (Mimosaceae) (W.G.). *Strepsicrates holotephras* (Meyrick) feeds on *Syzygium aromaticum* (L.) Merr. & Perry (W.G.), *Syzygium gracilipes* (A. Gray) Merr. & Perry (W.G.) and *Psidium cattleianum* Sabine (W.G.), and on leaves of *Psidium guajava* L. (R.V.) (Myrtaceae). *Acroclita physalodes* Meyrick feeds on flowers of *Barringtonia racemosa* (L.) Spreng. (Barringtoniaceae) (W.G.).

TINEIDAE : *Decadarchis sisyranthes* Meyrick feeds on leaves of *Pandanus odoratissimus* L.f. (Pandanaceae) (W.G.). *Decadarchis fibrivora* Meyrick feeds on leaves of *Pandanus caricosus* Spreng. (Pandanaceae) (W.G.).

LYONETIIDAE : *Opogona omoscopa* (Meyrick) feeds on seeds of *Tropaeolum majus* L. (Tropaeolaceae) (W.G.).

GRACILLARIIDAE : *Caloptilia xanthopharella* (Meyrick) feeds on leaves of *Glochidion cordatum* (J. Muell.) Seem. (Euphorbiaceae) (W.G.) and *Breynia disticha* Forst. f. (Euphorbiaceae) (W.G.).

HELIODINIDAE : *Hieromantis munerata* Meyrick feeds on flowers of *Melochia ?vitiensis* A. Gray (Sterculiaceae) (W.G.). *Hieromantis praemiata* Meyrick feeds on flowers of *Koelreuteria elegans* (Seem.) A. C. Smith (Sapindaceae) (W.G.).

EPERMENIIDAE : *Epermenia symmorias* Meyrick feeds on flowers of *Pittosporum brackenridgei* A. Gray (Pittosporaceae) (W.G.).

PYRALIDAE : *Marasmia poeyalis* (Boisduval) feeds on leaves of *Oryza sativa* L. (Poaceae) (R.L.). *Etiella behri* Zell. feeds on pods of *Cajanus cajan* (L.) Millsp. (Fabaceae) (W.G.). *Sylepta derogata* (F.) feeds on leaves of *Abelmoschus esculentus* (L.) Moench (Malvaceae) (W.G.) and *Hibiscus diversifolius* Jacq. (Malvaceae) (W.G.).

SPHINGIDAE : *Hippotion celerio* (L.) feeds on leaves of *Ipomoea batatas* (L.) Lam. (Convolvulaceae) (R.L.). *Gnathothlibus erotus* (Cramer) feeds on leaves of *Pentas lanceolata* (Forsk.) K. Schum. (Rubiaceae) (W.G.).

LYMANTRIIDAE : *Dasychira fidjiensis* Mabille and Vuillot feeds on leaves of *Rhizophora mangle* L. (Rhizophoraceae) (G.R.) and on leaves of *Psidium cattleianum* Sabine (Myrtaceae) (G.R.).

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